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^{68}Ga-PSMA PET/MR–Positive, Histopathology-Proven Prostate Cancer in a Patient With Negative Multiparametric Prostate MRI

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Abstract: Multiparametric MRI incorporating T2-weighted, diffusion-weighted, and dynamic contrast material–enhanced sequences is currently used for detection and localization of clinically important prostate cancer (PCa). The ^{68}Ga-labeled PET tracer targeting the prostate-specific membrane antigen (PSMA, ^{68}Ga-PSMA-11) is a promising diagnostic approach for staging and restating PCa. Recent studies suggest that ^{68}Ga-PSMA could also be used for primary PCa detection and localization. We report a case of a ^{68}Ga-PSMA PET/MR-positive lesion of the peripheral zone in a 73-year-old man with a negative preceding multiparametric MRI. Radical prostatectomy and subsequent histopathologic examination confirmed a Gleason 4 + 4 PCa.

Key Words: ^{68}Ga-PSMA, PET/MRI, prostate cancer, multiparametric MRI

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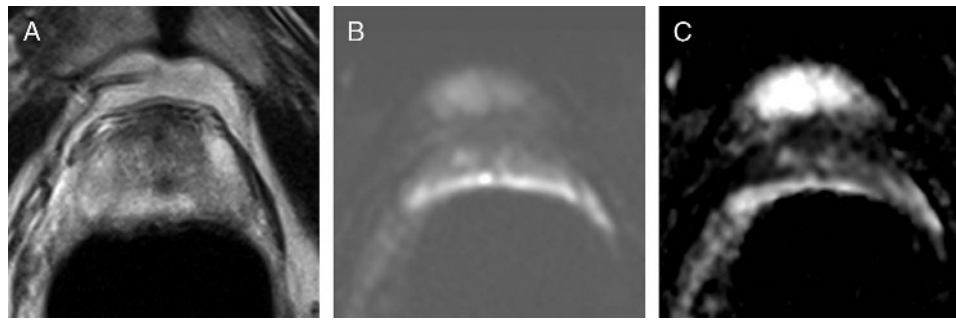

FIGURE 1. Multiparametric MRI (mpMRI). A 73-year-old man with newly diagnosed surge of prostate-specific antigen from 2.15 to 2.85 ng/mL. Transverse T2-weighted images (**A**) show slight hypointense signal in the peripheral zone basal posterior on both sides. Prostate Imaging Reporting and Data System (PI-RADS) version 2[1] using information from diffusion-weighted imaging (**B**) apparent diffusion coefficient (ADC) map (shown in **C**) and dynamic contrast-enhanced imaging (not shown) resulted in a PI-RADS scores of 2 for the right and left basal sextant. However, rectal gas limited image interpretation, especially because of artifacts in the diffusion-weighted images.

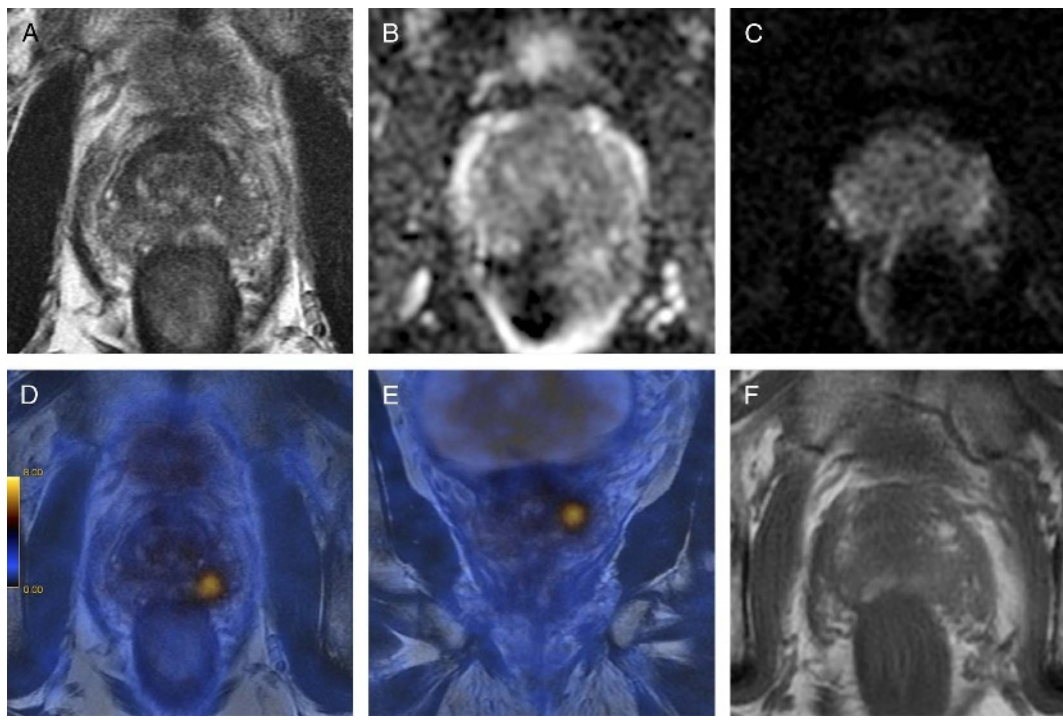

FIGURE 2. ^{68}Ga prostate-specific membrane antigen (PSMA) PET/MRI scan 1 month after a template biopsy and 8 months after the initial mpMRI of the prostate. Template biopsy revealed an adenocarcinoma of the prostate with Gleason score (GS) 4 + 4 = 8 in 2 of 33 cores. Prostate-specific antigen level was 3.82 ng/mL at scan time of the PET/MRI. Transverse T2-weighted images (**A**) show diffuse hypointense signal in the peripheral zone basal posterior on both sides, diffusion-weighted imaging (**B**) and ADC map shown in (**C**) do not demonstrate restricted diffusion. Axial (**D**) and coronal fused (**E**) ^{68}Ga-PSMA PET/MRI scans show a single PSMA-positive prostatic lesion of 6 × 6 × 6 mm in the left basal sextant with an SUV_{max} of 6.9. There was no evidence of local or distant metastasis. T1-weighted image (**F**) shows several postbioptic changes that are reported not to influence the PET.[2]

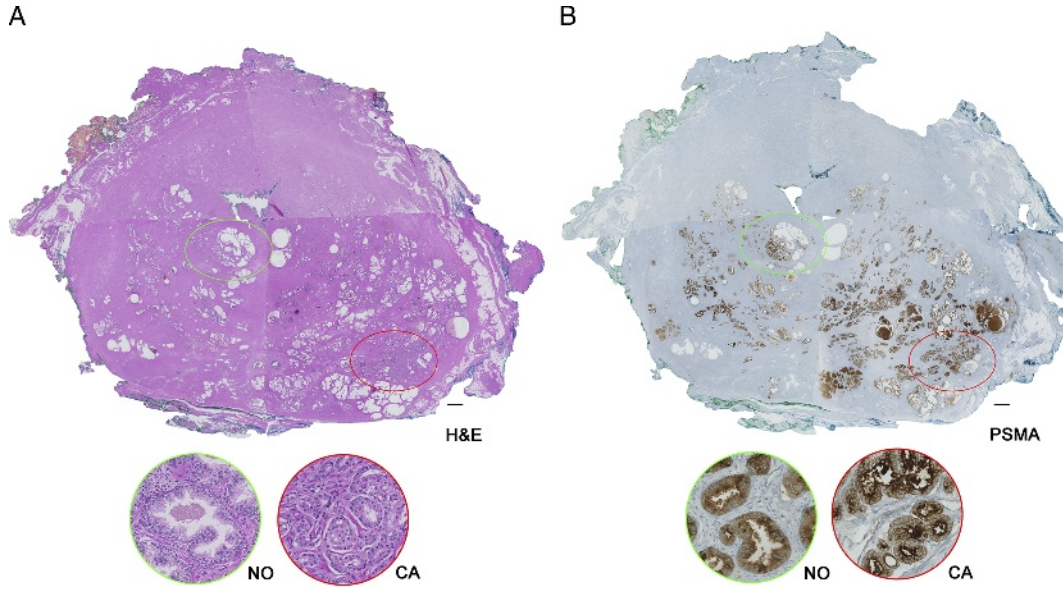

FIGURE 3. Reconstructed histopathological slices of the corresponding prostate after radical prostatectomy and pelvic lymph node (LN) dissection. H&E-stained (**A**) and PSMA-stained slice (**B**) show a GS 4 + 4 prostate cancer (PCa) of the left basal sextant that match the PSMA-positive lesion. Note the mainly membranous staining in PCa, whereas the benign tissue (NO) shows a predominant cytoplasmic staining[3] (insets). No positive LN was found in the LN dissection specimen. Despite multiple publications showing a good correlation between mpMRI with ADC and higher GS PCa,[4–8] cases with clinically relevant PCa and false-negative mpMRI have been reported.[9,10] More recently, cases with clinically relevant PCa, false-negative mpMRI, and true-positive PSMA PET have been reported.[11,12] PSMA PET/MR has been described as a potential tool for staging of high-risk PCa with improved sensitivity for LN and distant metastasis.[2] In our case, PSMA PET/MR clearly delineated the highly aggressive tumor, not detected on mpMRI and therefore improved the sensitivity for the local tumor. Furthermore, LN and distant metastasis could be ruled out. PSMA PET/MR might be used as a "trouble shooter" in selected cases with discrepancies between mpMRI and biopsy results.